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AUTHOR Epps, Susan; And Others
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ABSTRACT

Three types of definitions of learning disabilities (LD) (ability-achievement discrepancy, low achievement, and scatter) were examined to determine the extent of common variance within 48 school-identified LD children and 96 nonLD children (all elementary students). Both samples had previously been administered a battery of psychoeducational tests. Data were used to classify each child as LD or nonLD according to each of 14 operational definitions. A factor analysis resulted in two distinct groupings of LD students. Low achievement accounted for over four times the variance as ability-achievement discrepancy. Scatter did not contribute independently to classification. (Author/CL)

University of Minnesota

Research Report No. 98

AN ANALYSIS OF THE CONCEPTUAL FRAMEWORK UNDERLYING DEFINITIONS OF LEARNING DISABILITIES

Susan Epps, James E. Ysseldyke, and Bob Algozzine

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Susan Epps

Iowa State University

James E. Ysseldyke and Bob Algozzine

Institute for Research on Learning Disabilities

University of Minnesota

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Abstract

Various theoretical perspectives have contributed to the different types of definitions of learning disabilities (LD) that have been developed since the category was first established. To date, there has been little consensus on the definition of learning disabilities. In the present study, three kinds of definitions, ability-achievement discrepancy, low achievement, and scatter, were examined in order to determine the extent to which there was common variance. Subjects were 48 school-identified LD children and 96 non-LD children. Both samples had previously been administered a battery of psychoeducational tests. These data were used to classify each child as LD or non-LD according to each of 14 operational definitions. A factor analysis resulted in two distinct groupings of LD students; low achievement accounted for over four times the variance as ability-achievement discrepancy. Scatter did not contribute independently to classification. Implications for LD-identification practices are discussed.

An Analysis of the Conceptual Framework Underlying Definitions of Learning Disabilities

The field of learning disabilities (LD) has experienced considerable growth since its inception and has captured the interest of professionals from a wide variety of backgrounds. Lerner (1976) noted that several major disciplines have contributed to the study of learning disabilities. She grouped these disciplines into five categories: medicine, psychology, language, education, and other professions (e.g., optometry, audiology, and occupational therapy). Through the intermingling of these many professions, a multidisciplinary approach to the study of children and adolescents with learning disabilities evolved. The generic nature of learning disabilities, the multidisciplinary contributions, the different perspectives within a discipline, and the high interest of both professionals and parents have combined to generate a plethora of terms and definitions. Cruickshank (1972) addressed the issue of "variance in nomenclature" and noted that more than 40 English terms had been used in the literature to refer to the same children.

The confusion over definition is apparent in the wide variety of categorical labels given to these students. Today, students are identified as having perceptual and communication disorders (PCD), special learning and behavior problems (SLBP), or specific learning disabilities (SLD), or as being educationally handicapped (EH), brain injured (BI), or neurologically impaired (NI). These special-education categories differ from state to state.

The way in which learning disabilities is defined depends upon one's theoretical perspective. For example, diagnostic personnel who

emphasize brain-behavior relationships view LD students as having a neurological dysfunction. They define learning disabilities differently than do professionals who emphasize a functional analysis of the student's problem and the classroom environment. Certainly, one's conception about the nature of learning disabilities influences how one defines the problem and collects assessment data. Such variability in definitions may produce differences in the kinds of students who are identified.

The purpose of the present investigation was to examine various definitions of learning disabilities by collecting data on the kinds of students identified. Different theoretical perspectives of learning disabilities are reviewed and related to the types of students who are identified.

Conceptual Framework of Definitions of LD

Ability-achievement discrepancy. Although it was Bateman (1965) who popularized the discrepancy notion in the learning-disabilities movement, the concepts of underachievement and discrepancy between achievement and ability were first used by the remedial-reading specialists. As early as 1932, Monroe noted that "a child may fail to learn to read and yet be of adequate intelligence" (p. 1). Bond and Tinker (1957) also highlighted the concept of underachievement, stating that "the disabled reader is a child...who is not living up to his potential as a learner" (p. 83). Reading specialists emphasized identifying the "disabled reader" (whose reading achievement was less than his/her computed expectancy) rather than the "poor reader" (whose reading achievement was low but who was supposedly already achieving

up to his/her computed expectancy) for remedial-reading training. The field of learning disabilities paralleled the remedial-reading field with its attempts to differentiate "LD" students from "slow learners." A number of different formulas, similar to the reading-expectancy formulas, were developed in an attempt to quantify ability-achievement discrepancy. Among these were formulas developed by Myklebust (1968) and Algozzine, Forgnone, Mercer, and Trifiletti (1979), as well as the 1976 federal formula (USOE, 1976). The purpose of these formulas was to identify those students who were doing poorly in school yet were of average intelligence.

Academic-achievement deficit. Although an ability-achievement discrepancy is a typical requirement for classification as LD, by no means is there consensus that it is a useful concept. A number of studies (Algozzine et al., 1979; Algozzine, Ysseldyke, & Shinn, in press; Ysseldyke & Algozzine, 1979) have argued that LD is largely a category of low achievement, thus suggesting that the degree of students' achievement deficiencies should be considered when determining eligibility for LD placement. Various methods to operationalize low achievement (i.e., grade placement-achievement discrepancy) have been used. Schere, Richardson, and Bialer (1980) proposed a formula that averaged grade scores from group-administered and individually administered achievement tests. In contrast, Epps, Ysseldyke, and McGue (in press) examined standard scores alone without the use of a formula. The purpose of this approach was to identify those students who were doing poorly in school, regardless of their intelligence.

Scatter analysis. Many professionals have advocated the use of scatter analysis (also referred to as profile analysis and pattern analysis) to identify LD students. As noted by Sattler (1982), scatter refers to the pattern or configuration formed by subtest scaled scores. This approach to identification was influenced by research in the field that emphasized brain-behavior relationships and neurological dysfunctions. The concept of the brain and its relationship to behavior includes the notion that parts of the brain mature at different rates (e.g., Bender, 1963; Chusid, 1979; Cowan, 1979; Geschwind, 1964). If one part is slower in development than other parts, the result was thought to be an unusual pattern of skills and deficits that children and adolescents with learning disabilities supposedly demonstrated. Such concepts as developmental discrepancies (Kirk, 1962) and developmental imbalances (Gallagher, 1966) served as the impetus for scatter analysis.

In general, the intent of scatter analysis is to identify diagnostically different groups, and eventually the individuals composing them, on the basis of their differential performance on a number of different subtests (Rapaport, Gill, & Schafer, 1968; Wechsler, 1958). Thus, for example, the Wechsler Intelligence Scale for Children - Revised (WISC-R) frequently has been used in psychological assessment in attempts at differential diagnosis and identification of areas of specific strengths and weaknesses. Examining WISC-R profiles, then, is viewed as having diagnostic and remedial implications.

There are several approaches to scatter analysis. One approach

involves comparing Verbal-Scale IQ with Performance-Scale IQ, that is, examining Verbal-Performance discrepancies. A second method entails the comparison of subtest scaled scores. A third approach compares sets or categories of individual subtest scores. Bannatyne (1968, 1971, 1974, 1979) and Witkin, Dyk, Faterson, Goodenough, and Karp (1962) proposed that WISC (and/or WISC-R) subtests could be grouped into major categories and factors.

Many definitions of learning disabilities and efforts to operationalize these definitions have been developed since the category was first established. To date, there has been little agreement on the definition and measurement of learning disabilities. On the surface, the different definitions may look quite different and may identify different types of students. On the other hand, since many of the definitions deal with low achievement, the different definitions may be quite similar. In the present research, 14 definitions of LD were examined in order to determine the amount of common variance. In addition, the characteristics that differentiated students who were identified by many definitions from those who were identified by few definitions were delineated.

Method

Subjects

The school-identified LD sample consisted of two subsamples and included 48 students whose mean age was 9 years, 3 months (SD = 1 year, 5 months). The sample included 36 males (75%) and 12 females (25%). Mean aptitude and achievement scores were as follows: WISC-R Full Scale, 98.90 (SD = 11.44); Woodcock-Johnson Broad Cognitive

Ability, 94.70 (SD = 11.15); Woodcock-Johnson Reading Achievement, 84.66 (SD = 7.96); Woodcock-Johnson Mathematics Achievement, 88.82 (SD = 12.69); and Peabody Individual Achievement Test (PIAT) total score, 93.06 (SD = 8.38). Additional aptitude and achievement data are presented in Tables 1 and 2.

Insert Tables 1 and 2 about here

The non-LD sample consisted of four subsamples and included 96 students whose mean age was 10 years, 0 months (SD = 1 year, 3 months). No sex data were available for two of the four non-LD subsamples. Mean aptitude and achievement scores were as follows: WISC-R Full Scale, 102.78 (SD = 19.93); Woodcock-Johnson Broad Cognitive Ability, 100.50 (SD = 12.17); Woodcock-Johnson Reading Achievement, 98.21 (SD = 11.55); Woodcock-Johnson Mathematics Achievement, 99.10 (SD = 15.97); and Peabody Individual Achievement Test (PIAT) total score, 101.97 (SD = 10.02). Additional aptitude and achievement data are presented in Tables 1 and 2.

The subjects in the subsamples within the LD and non-LD samples were selected on the basis of different criteria. The various criteria are described in further detail below.

LD Sample

Subsample 1. Subjects were 24 fourth graders from metropolitan Minneapolis and St. Paul schools. The subsample included 19 boys and 5 girls with a mean age of 10 years, 1 month (SD = 5 months). They were identified as learning disabled by placement teams in the school

districts they attended. The exact criteria used by the schools for identification of students as LD were unknown. The students in this LD subsample had been selected for participation in a larger study within six months of their identification as learning disabled. This restriction in subject selection was used in order to reduce the effect of the intervention.

Subsample 2. Subjects were 24 elementary-school students referred for psychological evaluation due to learning difficulties in a school district in northern Minnesota. The subsample included 17 boys and 7 girls with a mean age of 8 years, 5 months (SD = 19 months). Students were diagnosed as LD by the school district's application of the "severe-deficit" criterion from the Woodcock-Johnson Psycho-Educational Battery (Woodcock & Johnson, 1977).

Non-LD Sample

Subsample 3. This subsample consisted of 24 low-achieving fourth graders from the same metropolitan area as the students in subsample 1. Subjects included 16 boys and 8 girls with a mean age of 10 years, 1 month (SD = 4 months). They had not been identified as LD by their school districts, but scored at or below the 25th percentile on the Iowa Tests of Basic Skills administered during the fall of the school year. The low-achieving subsample also had been group-tested within six months of their selection for participation.

Subsample 4. Subjects were 24 elementary-school students referred for psychological evaluation due to learning difficulties. There were from the same northern Minnesota school district as the

students in subsample 2. The subsample included 13 boys and 11 girls with a mean age of 9 years, 6 months (SD = 23 months). These students had been declared ineligible for LD services by the school district's application of the "severe-deficit" criterion from the Woodcock-Johnson Psycho-Educational Battery.

Subsample 5. Subjects were 24 third-grade children in regular classrooms who were selected randomly from 12 elementary schools in a school district comprised of several northern Minneapolis suburbs. The number of boys and girls in the subsample was unspecified; the mean age of the group was 9 years, 4 months (SD = 6 months). The students were a subsample of a group included in criterion-related validity studies for the Woodcock-Johnson Psycho-Educational Battery.

Subsample 6. Subjects were 24 fifth-grade children in regular classrooms who were selected randomly from 12 elementary schools in the same district from which subsample 5 was selected. The number of boys and girls in the subsample was unspecified; the mean age of the group was 11 years, 2 months (SD = 4 months). The students were a subsample of a group included in criterion-related validity studies for the Woodcock-Johnson Psycho-Educational Battery.

Procedure

Assessment data were collected for all six subsamples as part of larger studies conducted by the Institute for Research on Learning Disabilities at the Univerity of Minnesota. Subjects in subsamples 1 and 3 were tested from January to May of 1979 by trained graduate students. Subjects in subsamples 2 and 4 were tested during the 1979-1980 school year by certified school psychologists within the

school district as part of the diagnostic assessment. Subjects in subsamples 5 and 6 were tested in April and May of 1976. The technical manual (Woodcock, 1978) for the Woodcock-Johnson did not identify testing personnel for these students.

The definition of learning disabilities was operationalized in 14 ways. The operational definitions were grouped into three major categories: (a) ability-achievement discrepancy, (b) grade placement-achievement discrepancy (i.e., low achievement), and (c) scatter. Specific operational definitions used to determine classification as LD or non-LD are described below. These are summarized in Table 3.

Insert Table 3 about here

Ability-achievement discrepancy. Six forms of ability-achievement discrepancy definitions were used.

Definition 1 was the 1976 federal formula for severe discrepancy level. The proposed formula for determining the presence of a severe discrepancy was as follows:

$$CA\left(\frac{IQ}{300} + 0.17\right) - 2.5 = \text{severe discrepancy level (SDL)}$$

If a student's academic achievement level was at or below the federally defined SDL on at least one measure, then the student was classified as LD. Achievement grade scores for W-J Mathematics, W-J Written Language, PIAT Mathematics, PIAT Reading Recognition, PIAT Reading Comprehension, and PIAT Spelling were used.

Definitions 2-4 were various forms of the 1977 federal definition for severe discrepancy. Since the 1977 federal definition did not

specify the amount of discrepancy between ability and achievement that is required, the definition was operationalized in three ways to indicate different amounts of discrepancy.

Definition 2 specified a difference of 10 or more points between a student's WISC-R Full-Scale IQ and at least one of the standard scores for W-J Mathematics, W-J Written Language, PIAT Mathematics, PIAT Reading Recognition, or PIAT Reading Comprehension; if such a difference was found, then the student was classified as LD.

Definition 3 specified a difference of 20 or more points between a student's WISC-R Full-Scale IQ and at least one of the standard scores for W-J Mathematics, W-J Written Language, PIAT Mathematics, PIAT Reading Recognition, or PIAT Reading Comprehension; if such a difference was found, then the student was classified as LD.

Definition 4 specified a difference of 30 or more points between a student's WISC-R Full-Scale IQ and at least one of the standard scores for W-J Mathematics, W-J Written Language, PIAT Mathematics, PIAT Reading Recognition, or PIAT Reading Comprehension; if such a difference was found, then the student was classified as LD.

Definition 5 was the alternative to the federal formula proposed by Algozzine et al, (1979). The alternative formula for determining the presence of a severe discrepancy was as follows:

$$.5\left[\frac{IQ}{100} \times (CA - 5.5)\right] = SDL$$

If a student's academic-achievement level was at or below the alternative SDL on at least one measure, then the student was classified as LD. Achievement grade scores for W-J Mathematics, W-J Written Language, PIAT Mathematics, PIAT Reading Recognition, and PIAT

Reading Comprehension were used.

Definition 6 was the Myklebust Learning Quotient. A student who earned a learning quotient (LQ) of 89 or below in one or more areas was classified as LD according to the following formula:

$$LQ = \frac{\text{Achievement-age score}}{\text{Expectancy age}} \times 100$$

Achievement, measured by W-J Mathematics and Written Language clusters and PIAT Mathematics, Reading Recognition, and Reading Comprehension subtests, was compared to expectancy based upon the average of the child's mental age (derived from WISC-R IQ), chronological age, and grade-placement age.

Grade placement-achievement discrepancy (low achievement). Four forms of grade placement-achievement discrepancy definitions were used.

Definition 7 specified that at least one of a student's standard scores on W-J Reading, W-J Mathematics, PIAT Mathematics, PIAT Reading Recognition, and PIAT Reading Comprehension was at or below 85; if this score was found, the student was classified as LD.

Definition 8 specified that at least one of a student's standard scores on W-J Reading, W-J Mathematics, W-J Written Language, PIAT Mathematics, PIAT Reading Recognition, and PIAT Reading Comprehension was at or below 85; if this score was found, the student was classified as LD.

Definition 9 specified that at least one of a student's standard scores for W-J Reading, W-J Mathematics, W-J Written Language, PIAT Mathematics, PIAT Reading Recognition, and PIAT Reading Comprehension was at or below 77; if this score was found, the student was

classified as LD.

Definition 10 specified that at least one of a student's standard scores for W-J Reading, W-J Mathematics, W-J Written Expression, PIAT Mathematics, PIAT Reading Recognition, and PIAT Reading Comprehension was at or below 70; if this score was found, the student was classified as LD.

Scatter. Four forms of scatter definitions were used.

Definition 11 was a Verbal-Performance discrepancy at the .15 level of significance. Thus, a difference of 9 or more points between WISC-R Verbal IQ and Performance IQ indicated classification as LD.

Definition 12 was a Verbal-Performance discrepancy at the .05 level of significance. Thus, a difference of 12 or more points between WISC-R Verbal IQ and Performance IQ indicated classification as LD.

Definition 13 was a Verbal-Performance discrepancy at the .01 level of significance. Thus, a difference of 15 or more points between WISC-R Verbal IQ and Performance IQ indicated classification as LD.

Definition 14 specified a difference of 10 or more points between scaled scores on the highest and lowest WISC-R subtests; if this difference was found, then the student was classified as LD. A scaled-score range of 10 was selected since this Full-Scale range occurred in 15% or less of the WISC-R standardization sample.

Results

Results are presented in two general areas. First, the congruence across definitions in the numbers of students identified as

LD was investigated by performing a factor analysis. Second, characteristics that differentiate students who are identified by few definitions from those who are identified by many definitions were delineated.

Congruence in LD Students Across Definitions

To ascertain the extent to which the 14 operational definitions of learning disabilities identified the same types of students as LD or non-LD, a factor analysis was performed using tetrachoric (r_t) coefficients. Exact formulas for computing tetrachoric correlations are extremely complex. Therefore, tetrachoric correlations were estimated from four-fold contingency tables using Davidoff and Goheen's (1953) table. When the 2 x 2 contingency table contains a 0, r_t is indeterminate. To obtain a reasonable estimate of the tetrachoric coefficient in these cases, a 1 was substituted whenever a 0 appeared in a contingency table. The adjusted correlation matrix appears in Table 4; those r_t's that were derived by adjusting 0s to 1s are noted in the table.

Insert Table 4 about here

The r_t matrix was factor analyzed via principal components. Initial communality estimates were 1.00. Factoring was stopped when Eigenvalues no longer exceeded 1.00. Two factors were retained. Factor 1 accounted for 69.8% of the variance and had an Eigenvalue of 9.77; factor 2 accounted for 16.2% of the variance and had an Eigenvalue of 2.27. Together, the two factors accounted for 86.0% of

the total variance in the matrix.

Both varimax and promax (i.e., orthogonal and oblique) rotations were performed. The factor loadings on both rotations were essentially the same with only minor numerical differences. When an oblique solution was allowed, the factors were correlated only slightly (r = .31). Therefore, the varimax rotation is presented here. Table 5 is a list of the rotated varimax factor loadings and final communality estimates for each definition.

Insert Table 5 about here

Definitions 2 and 3 did not load on factor 1. However, factor 1 had large positive loadings on definitions 1, 5, and 6 (operationalizations of ability-achievement discrepancy), and 7, 8, 9, and 10 (operationalizations of low achievement). All of these definitions are similar in that they reflect some degree of low achievement. Definition 4 had a moderate loading. Definitions 11, 12, 13, and 14 were negatively correlated with the underlying factor. These definitions are operationalizations of scatter with small, rather than large, amounts of scatter being associated with classification as learning disabled. It appears, then, that factor 1 represents low achievement.

Factor 2 had substantial loadings on definitions 2 and 3 with lesser loadings on definitions 1 and 4. Definitions 1, 2, 3, and 4 are all operationalizations of ability-achievement discrepancy. Therefore, it appears that factor 2 represents discrepancy notions of

learning disabilities.

Characteristics of Students Identified by Few and Many Definitions

The number of definitions under which each student was classified as LD was determined. As can be seen in Figure 1, greater percentages of non-LD students were classified by few (0-3) definitions and greater percentages of LD students were classified by many (8-13) definitions. An examination of the average number of definitions under which students were classified indicated that children in the LD group qualified under slightly more definitions ($\overline{X}$ = 5.41, SD = 3.27) than children in the non-LD group ($\overline{X}$ = 3.75, SD = 2.48). However, inspection of Figure 1 also reveals 100% overlap in the distributions of the two groups. Thus, knowing how many definitions a student qualifies under provides little help in predicting the group, LD or non-LD, to which the student belongs.

Insert Figure 1 about here

Of particular interest were the characteristics that differentiated students qualifying under a large number of definitions from those qualifying under a small number of definitions. To determine these characteristics, the total sample was divided into a top, middle, and bottom tertile in terms of the number of definitions under which students qualified. Out of the total sample for whom complete data were available, 32 students were in the top tertile (identified by six or more definitions), 46 students were in the middle tertile (identified by three to five definitions), and 31

students were in the bottom tertile (identified by zero to two definitions).

Use of the contingency tables for the definitions, as well as intermediate tabulations of student classification under each definition, provided information on the number of students who qualified under the most restrictive definition in each of the three categories of definitions (i.e., definitions 4, 10, and 13). Students with the severest discrepancies between ability and achievement (those identified by definition 4) logically also were characterized by milder-discrepancy criteria (definitions 2 and 3). Students with the largest achievement deficits (those identified by definition 10) also had to be identified by definitions 8 and 9, which required milder levels of low achievement. Students with the greatest scatter (those identified by definition 13) also had to be identified by definitions 11 and 12, which required less scatter.

Although there were high correlations between definitions within categories of definitions (see Table 4), there were smaller correlations between definitions across categories. There was little relationship between classification based upon the strictest low-achievement definition and the strictest scatter definition (r_t = .13) and between the strictest severe-discrepancy definition and the strictest scatter definition (r_t = .38). There was a higher but only moderate relationship between the severest discrepancy definition and the lowest achievement definition (r_t = .60). These observations are also supported by the factor-analytic results.

Since each severe definition functionally requires identification

by two less severe definitions and since students in the bottom tertile met no more than two definitions, it is obvious that no student identified by definition 4, 10, or 13 could be in the bottom tertile since he/she would have to be identified by at least three definitions. However, the student could be in the middle or top tertile. The extent to which students who qualified under definition 4, 10, or 13 were found in the middle and top tertiles was examined next.

Of the 32 students in the top tertile, 25 (78.1%) were identified by definition 4, 10, or 13, or by some combination of these. As would be expected, no students in the bottom tertile, who were identified by few definitions, were ever identified by definitions 4, 10, or 13 (see Table 6). No student qualifying under definition 4 or 10 was in the middle tertile. Ten students identified under definition 13, however, were in the middle tertile.

Insert Table 6 about here

Although the factor analysis indicated the relative independence of aptitude-achievement discrepancy and low achievement, with scatter loading on both factors, an attempt was made to clarify further the relationship among the three severe definitions. Table 7 shows the cross-tabulation of students who were jointly classified by the three definitions. It must be noted that, in addition to the small, absolute numbers of students jointly classified, only one student was classified under all three extreme definitions. Thus, it appears that

these three definitions, which account for 78.1% of the students in the top tertile, identify different students as LD.

Insert Table 7 about here

Tabulations of classifications of students in the bottom tertile provided information on the characteristics of students who were identified by few definitions. Of the 31 students in the bottom tertile, 8 (28.8%) were classified by none of the definitions and 16 (51.6%) were identified by only one definition. Of those 16 students who qualified under only one definition, 12 (75%) were classified under definition 2 or 6.

Table 8 is a list of the numbers of students identified by one or two definitions and the definitions under which they were classified. Of the 31 students in the bottom tertile, 13 (41.9%) were classified by definition 2, 8 (28.8%) were classified by definition 6, and 4 (12.9%) were classified by definition 11. Definitions 7, 8, and 14 identified only small percentages of the group (6.5% each). Definition 2 (10-point difference between ability and achievement) and definition 6 (Myklebust Learning Quotient) both reflect mild degrees of ability-achievement discrepancy. Taken together, they describe two-thirds (67.7%) of the students who were identified by one or two definitions. Definition 11 (9-point difference between WISC-R Verbal and Performance Scales) reflects a mild degree of scatter and describes an additional 12.9% of these students.

Insert Table 8 about here

It appears, then, that students who were identified by many definitions exhibited severe ability-achievement discrepancy, very low achievement, or large Verbal-Performance discrepancy. Clearly, they differed from students identified by few definitions, none of whom qualified under any of the three most restrictive definitions. Students who were identified by few definitions exhibited mild levels of ability-achievement discrepancy.

Discussion

Several major disciplines have contributed to the study of learning disabilities (Lerner, 1976); diverse theoretical orientations and definitional criteria thus have resulted. The different conceptualizations of learning disabilities have produced at least four general classes of definitions: ability-achievement discrepancy, academic-achievement deficiency, scatter, and process disorder. Operationalizations of three of these were included in this study; the 14 definitions that were used represent a subsample of the large number of possible operational definitions. A factor analysis of the intercorrelations between these definitions revealed only two empirical groupings, low achievement and ability-achievement discrepancy. Although four operationalizations of scatter were included, a scatter factor did not emerge. Therefore, scatter did not contribute independently to classification. Essentially, the three types of conceptualizations included in this investigation were

reduced to two, with low achievement accounting for over four times the variance as ability-achievement discrepancy.

For this sample and with these definitions, the data suggest that the category of learning disabilities is primarily a category of low achievement. It must be noted, however, that one limitation in the present study was the lack of a clear differentiation between ability-achievement discrepancy and low achievement; correlations between the two types of definitions were generally moderate to high. Moreover, definitions that operationalized ability-achievement discrepancy loaded on both the low-achievement and ability-achievement discrepancy factors. This lack of differentiation may have been an artifact of the sample selected. Since most of the students performed in the average range on the WISC-R, manifestation of an ability-achievement discrepancy would necessarily dictate that the student also exhibit low achievement. Had more students with high IQ scores and average achievement been included, a direct attempt to distinguish students with ability-achievement discrepancies from students having low achievement could have been made.

From the diversity of theoretical orientations presented in the literature, there does not appear to be any scientific basis for preferring one type of definition over another. The lack of agreement on how to define learning disabilities has had a significant impact on the research literature. Researchers have varied considerably in how they identified students as LD (see Keogh, Major, Omori, Gandara, & Reid, 1980; Olson & Mealor, 1981; Torgesen & Dice, 1980). State departments of education (Mercer, Forgnone, & Wolking, 1976) and

"model" Child Service Demonstration Centers for LD students (Thurlow & Ysseldyke, 1979) also have varied substantially in how they identified students as learning disabled.

Although low achievement accounted for over two-thirds of the variance, heterogeneity in the sample identified as learning disabled was apparent. The group of students identified by many definitions, as well as the group identified by few definitions, were found to be heterogeneous. Of those students identified by many definitions, some exhibited severe ability-achievement discrepancy, some had very low achievement, and some showed large Verbal-Performance discrepancies. However, only one student was characterized by all three. Of those students identified by few definitions, two-thirds exhibited mild ability-achievement discrepancy (when two different operationalizations were used), but other manifestations were also apparent (i.e., mild Verbal-Performance discrepancy, mild low achievement, and moderate subtest scatter).

The three types of definitions used in the present research, ability-achievement discrepancy, low achievement, and scatter, reflect different theoretical orientations, and on the surface, appear dissimilar. In the 14 operational definitions, low achievement was found to be the factor that contributed to LD classification in most of the cases. This finding suggests that the field of learning disabilities might benefit from discarding the psycho-neurological conceptualization with its focus on scatter analysis, and concentrating instead on the identification of low achievement. One must even question whether information about IQ and ability-

achievement discrepancy is necessary for classification. When attention is directed toward students' low achievement, attempts at remediation can follow directly from assessment. Such remedial efforts are not possible with most approaches to scatter analysis (i.e., those not including academic-achievement data).

Psychometric data were not available for considering other types of definitions of learning disabilities, such as those involving process disorders. If such definitions had been used and different results were obtained, one might argue that learning disabilities should be reconceptualized to include only process disorders. It is important to note, however, that such a definition would require the development of reliable, valid, and adequately normed devices. Moreover, problems associated with attempts to operationalize other types of definitions also would affect process definitions.

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Table 1

Means and Standard Deviations of Performance on Aptitude Measures for LD and Non-LD Groups[a]

		LD	Non-LD	Total
WISC-R				
Full Scale	$\bar{X}$	98.90	102.78	101.49
	SD	11.44	12.93	12.56
	N	48	96	144
Verbal Scale	$\bar{X}$	95.36	101.74	99.61
	SD	12.23	13.77	13.64
	N	48	96	194
Performance Scale	$\bar{X}$	103.26	103.78	103.60
	SD	12.13	13.34	13.00
	N	48	96	144
Information	$\bar{X}$	94.90	98.96	97.60
	SD	11.54	13.68	13.20
	N	48	96	144
Similarities	$\bar{X}$	97.60	102.61	100.94
	SD	16.40	14.51	15.35
	N	48	96	144
Arithmetic	$\bar{X}$	90.21	98.44	95.70
	SD	10.83	13.84	13.46
	N	48	96	144
Vocabulary	$\bar{X}$	96.36	101.62	99.86
	SD	14.33	14.12	14.45
	N	48	96	144
Comprehension	$\bar{X}$	100.83	106.41	104.55
	SD	21.51	14.60	17.42
	N	48	96	144
Digit Span[b]	$\bar{X}$		97.30	
	SD		12.64	
	N		48	
Picture Completion	$\bar{X}$	102.92	104.38	103.89
	SD	12.42	12.69	12.65
	N	48	96	144

Table 1 (continued)

		LD	Non-LD	Total
Picture Arrangement	$\bar{X}$	106.46	106.04	106.18
	SD	13.23	14.99	14.43
	N	48	96	144
Block Design	$\bar{X}$	101.78	101.25	101.43
	SD	12.40	16.08	14.93
	N	48	96	144
Object Assembly	$\bar{X}$	104.30	102.76	103.27
	SD	14.66	13.36	13.79
	N	47	96	143
Coding	$\bar{X}$	96.52	99.94	98.83
	SD	13.48	15.76	15.16
	N	46	96	142
Mazes[b]	$\bar{X}$		107.81	
	SD		14.21	
	N		48	
Woodcock-Johnson				
Reading	$\bar{X}$	97.31	102.93	101.06
	SD	11.93	12.37	12.48
	N	48	96	144
Mathematics	$\bar{X}$	94.71	99.20	97.70
	SD	11.92	12.98	12.84
	N	48	96	144
Written Language	$\bar{X}$	91.96	100.28	97.50
	SD	11.10	13.01	13.06
	N	48	96	144
Knowledge	$\bar{X}$	93.00	100.88	98.25
	SD	11.68	12.75	12.98
	N	48	96	144
Broad Cognitive	$\bar{X}$	94.70	100.50	98.67
	SD	11.15	12.17	12.12
	N	48	96	144

[a]Test scores are standard scores with means of 100 and standard deviations of 15.

[b]The Digit Span and Mazes subtests of the WISC-R were not administered to the LD group and to only half of the NLD group.

Table 2

Means and Standard Deviations of Performance on Achievement Measures for LD and Non-LD Groups[a]

		LD	Non-LD	Total
Woodcock-Johnson				
Reading	$\bar{X}$	84.66	98.21	93.66
	SD	7.96	11.55	12.30
	N	48	95	143
Mathematics	$\bar{X}$	88.82	99.10	95.67
	SD	12.69	15.97	15.74
	N	48	96	144
Written Language	$\bar{X}$	84.88	95.58	92.02
	SD	7.23	12.25	11.90
	N	48	96	144
PIAT				
Mathematics	$\bar{X}$	96.20	102.21	100.21
	SD	10.36	11.56	11.50
	N	48	96	144
Reading Recognition	$\bar{X}$	93.23	103.06	99.78
	SD	8.94	10.32	10.94
	N	48	96	144
Reading Comprehension	$\bar{X}$	94.51	102.28	99.89
	SD	11.09	11.52	11.89
	N	41	92	133
Spelling	$\bar{X}$	89.98	99.74	96.49
	SD	9.44	11.95	12.06
	N	48	96	144
General Information	$\bar{X}$	98.56	102.86	101.43
	SD	10.99	10.11	10.57
	N	48	96	144
Total	$\bar{X}$	93.06	101.97	99.00
	SD	8.38	10.02	10.39
	N	48	96	144

[a]Test scores are standard scores with means of 100 and standard deviations of 15.

Table 3

Fourteen Operational Definitions of Learning Disabilities[a]

Ability-achievement discrepancy	
Definition 1	1976 federal formula for severe discrepancy
Definition 2	10-point difference between ability and achievement
Definition 3	20-point difference between ability and achievement
Definition 4	30-point difference between ability and achievement
Definition 5	Alternative formula for severe discrepancy
Definition 6	Myklebust Learning Quotient
Low achievement	
Definitions 7-8	1.0 to 1.5 standard deviations below mean on selected achievement subtests
Definition 9	1.5 to 2.0 standard deviations below mean on selected achievement subtests
Definition 10	2.0 or more standard deviations below mean on selected achievement subtests
Scatter	
Definition 11	9-point difference between WISC-R Verbal and Performance Scales
Definition 12	12-point difference between WISC-R Verbal and Performance Scales
Definition 13	15-point difference between WISC-R Verbal and Performance Scales
Definition 14	10-point difference between highest and lowest scores on WISC-R subtests

[a]The definitions are explained in greater detail in the Method section.

Table 4

Adjusted Tetrachoric Correlation Matrix Among Definitions[a]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	100	61	65	80	95	80[b]	70	82[b]	56	81	-12	-01	-21	25
2		100	95[b]	68[b]	-17	37	23	35	21	38	05	10	13	20
3			100	84	01	42	42	44	11	55	-05	16	12	24
4				100	72	62	79[b]	74[b]	56	60	14	19	38	53
5					100	58[b]	66[b]	61[b]	68	92	-60	-44	-26	20
6						100	75	81	46	93	-11	-16	-09	-08
7							100	91	92	75[b]	14	10	17	09
8								100	90[b]	70[b]	14	06	02	-01
9									100	93[b]	20	05	12	10
10										100	09	15	13	19
11											100	98[b]	95	60
12												100	98	53
13													100	72
14														100

[a]Decimals were deleted.

[b]These estimated values of r_t were computed by substituting a 1 for the 0 in the contingency tables.

Table 5

Varimax Factor Loadings for 14

Definitions of Learning Disabilities

Definition	Factor 1	Factor 2	Communalities
1	.86595	.41416	.92
2	-.00944	.95982	.92
3	.13227	.96532	.95
4	.65248	.64257	.84
5	.91863	.03764	.85
6	.87849	.32447	.88
7	.93924	.00679	.88
8	.93078	.12082	.88
9	.89466	-.23368	.86
10	.91503	.09928	.85
11	-.83163	-.38685	.84
12	-.88173	-.31321	.88
13	-.87445	-.31157	.86
14	-.78383	-.16730	.64

Table 6

Cross-Tabulations of Students Identified by 0-2 Definitions (Bottom Tertile), 3-5 Definitions (Middle Tertile), and 6 or More Definitions (Top Tertile) with the Most Restrictive Definitions (4, 10, and 13)

	Tertiles		
Definitions	Bottom	Middle	Top
4	0	0	8
10	0	0	8
13	0	10	15

Table 7

Joint Occurrences of Students Classified by

Definitions 4, 10, and 13

		Definitions	
		10	13
Definitions	4	2	4
	10		2

Table 8

Cross-Tabulation of Students Identified by 1-2 Definitions (Bottom Tertile) with the Definitions Under Which They Were Classified

Definition	Number of Students Classified
2	13
6	8
11	4
7	2
8	2
14	2

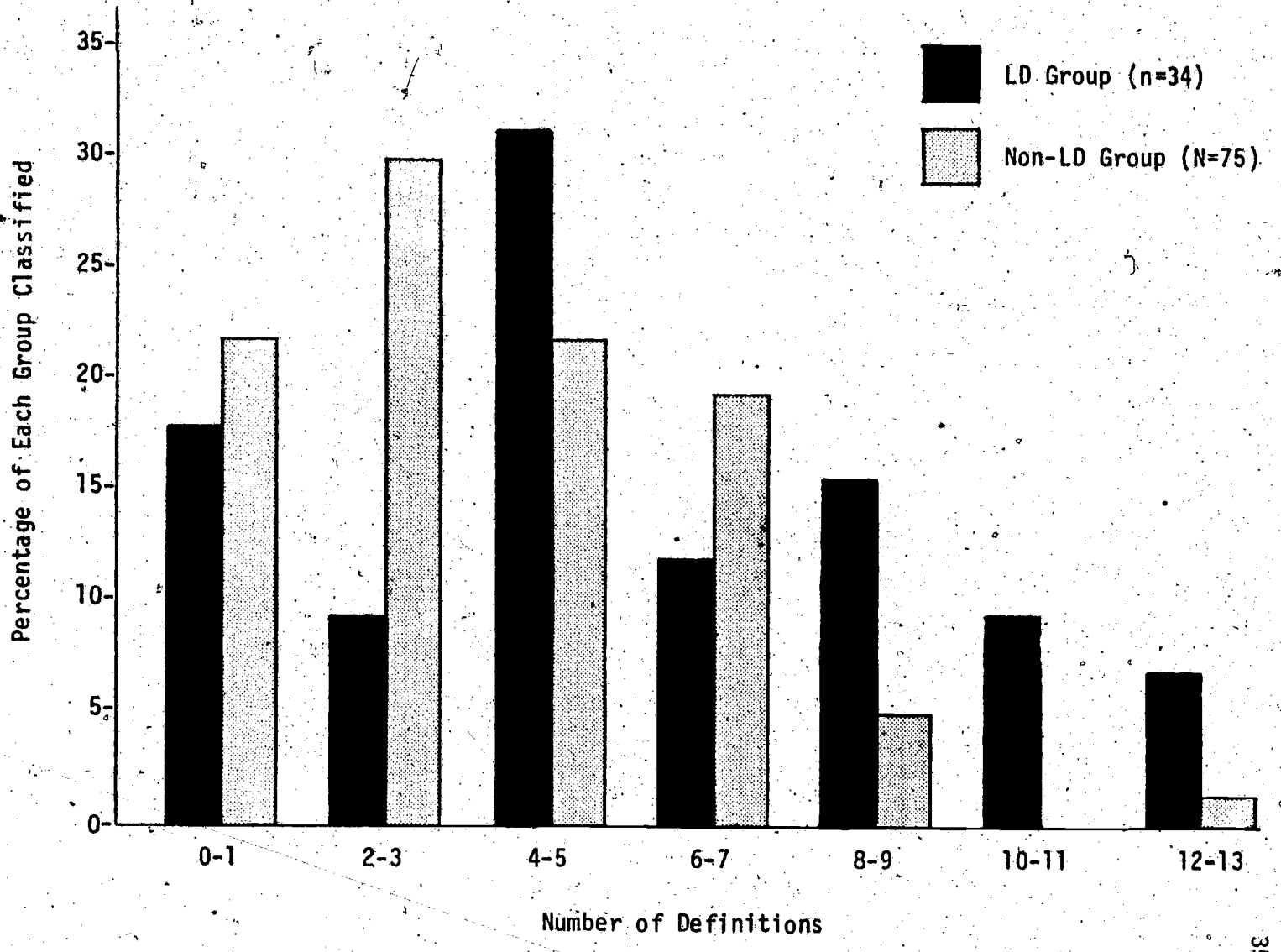

Figure 1. Number of definitions under which students were classified, by LD and non-LD groups.

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